GUS-0021
Copy 2 of 2.

16 April 1958

MEMORANDUM FOR : Project Director

SUBJECT : Visit to Materials Lab, Wright Field

1. On 15 April 1958 I visited the Materials Laboratory at Area B, Wright-Patterson AFB. My object was to find out all they knew about high modulus fiberglass or plastic materials, and to ascertain what contracts they had for development of materials. I had present during the discussion a representative from the Structures Branch of the Aircraft Laboratory as well as the following Materials Laboratory personnel:

Col. Dieffenderfer, Chief	(Tel. ext. 27138)
Mr. Ed Glass, Tech. Dir.	27138
Mr. R. T. Schwartz, Ph.D.	27120

2. I explained USAF's (Mr. Horner's) interest in getting the Aircraft Industry to more fully utilize plastics, such as fiberglass, in aircraft design, and wanted all information to pass on to Mr. Horner so that he could better know when industry's salesmen were giving us realistic information and so enable Mr. Horner to place pressure on executives of aircraft companies when the opportunity presented itself. I also explained that Owens-Corning [redacted] had been in discussion with me, ARDC, and other Headquarters personnel, and I was interested in finding out just what the Materials and Aircraft Laboratories had under contract with them or any other plastic companies and what the laboratories' evaluation came to.

25X1A5a1

3. In preliminary discussion I mentioned the Owens-Corning work on flake glass which should have a modulus of elasticity in the order of 10^7 lb/in.^{2}. Here is a most important fact which should not be overlooked. Although glass fibers or glass flakes in themselves have an E value of 10^7 lb/in.^{2}, when they are mixed with resin, or woven into cloth and impregnated with resin, and made into a finished fabricated item, the modulus of elasticity (E) will be about 3 to 3.5 x 10^6 lb/in.^{2}, or in essence the final workable E is about 1/3 the strength of the separate fibers.

4. The Materials Laboratory has extensive contractual effort underway to develop new materials, with better physical characteristics. Some of the more important and more pertinent to our effort are:

SECRET

A. Owens-Corning

1. Quality control, $300,000. Work effort is centered on raising design allowables to which industry now designs. (AMC Mfg. Methods made actual contract negotiation)

2. High Modulus Fibers, Beryllium Oxide, with E of 20×10^6 psi, cost $30,000/yr. More money is available, but Materials Lab people say Owens-Corning is "dragging its feet" on this development. Why, they don't know. Materials Lab would be willing to put more money in if they thought such would help. This 20×10^6 lb/in^2 E material couldn't be ready for our project use within one year.

3. Flake glass. Depends on glass used and especially on size, shape, and orientation of flakes in solution and final fabricated material. This is still very experimental. The Linden Lab of Army Ordnance has a contract to push flake glass. To date not enough of this has been produced to get accurate test specimens. Such small efforts as $15,000 surely would not give us accurate answers within 3 months. It is expected that final flake glass material will achieve a working E of 6×10^6 psi and allow flexures stress of 25,000 psi, tensile stress of 45,000 and compression of 35,000 psi.

25X1A5a1 B. [redacted]

1. Develop plastic adhesives, $55,000

2. Expect to give contract to develop ceramic adhesives.

25X1A5a1 C. [redacted]

1. Contract for development of high modulus, high temp fibers, $50,000/yr.

5. In answer to my questioning about who can best design fiberglass structures for aircraft, all Lab personnel were unanimous against aircraft industry. They say the aircraft industry are sheet metal workers and just don't know how to get the most out of plastic designing. The 25X1A Lab's representatives all recommended either [redacted] to design and build aircraft wings, tails or other primary load carry sections if best plastic design with weight saving and greatest attainable strength is necessary.

6. In summary, the Materials Laboratory

   a. Says flake glass is at least a year away.

   b. Believe present contracts for E of 20 x 10^6 psi, while at least a year away, should be better than flake glass in certain applications.

   c. Recommend we use best present E fiberglass materials with epoxy resin.

25X1A

   d. Recommend we have [redacted] do our fiberglass design, stress analysis, and fabrication.

7. I recommend the following action:

   a. We have Lockheed finalize the Gusto design from electronic, Lincoln Lab, findings, and build a wind tunnel model, and determine air load distribution over wings, tail, fuselage, etc., just as they would do if Gusto were to be made from all metal.

   b. Then run a stress analysis as if Gusto were to be made of all metal.

   c. Then mark on the drawings the parts which are to be fiberglass.

25X1A

   d. Give these drawings to [redacted] and have them design the fiberglass parts to include method of attaching to metal, and then run a stress analysis on the whole Gusto again. Discuss their work with Lockheed. If agreement is reached on design, loading, fabrication, etc., a prototype should be built.

25X1A 25X1A 25X1A

   e. Lockheed would build the basic metal plane, and [redacted] or [redacted] would build the plastic parts and together Lockheed and [redacted] or Goodyear would marry the plastic parts to the metal.

   f. Next, I would static test the finished airplane to at least designed limit load multiplied by 1.5 per CAR para 4b dated 20 July 1950, similar to U-2 specs.

25X1A

   g. If no failures occurred, I would then take this airplane as number one to [redacted] and begin to fly it.

   h. I would similarly static test each successive Gusto airplane produced.

8. Attached are some reports and items on fiberglass properties which I had on hand or which I picked up at Wright-Patterson AFB. This report, together with the attachments, covers all the information I have on fiberglass.

J. A. GIBBS
Deputy Project Director